Observations on Juvenile Chum and Chinook and Spawning Chinook in the Nanaimo River, British Columbia, during 1975-1981

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OBSERVATIONS ON JUVENILE CHUM AND CHINOOK AND SPAWNING CHINOOK IN THE NANAIMO RIVER, BRITISH COLUMBIA, DURING 1975-1981.

by

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ABSTRACT

Healey, M. C., and F. P. Jordan. 1982. Observations on juvenile chum and chinook and spawning chinook in the Nanaimo River, British Columbia, during 1975-1981. Can. MS Rep. Fish. Aquat. Sci. 1659: iv + 31 p.

During 1975, 1976, and 1979-1981 we monitored the downstream run of salmon fry in the Nanaimo River. During 1979 and 1980 we collected information on the migration and distribution of chinook smolts in the river and on the abundance and composition of spawning chinook. Chinook fry run totalled 132-752 thousand and chum fry run 13-52 million. Chum tended to be distributed at random across the river while chinook were concentrated near shore. Both species were more abundant near the surface than near the bottom. Chinook smolts migrated seaward mainly in early June and were concentrated near the centre of the river. Adult chinook were most abundant below the Island Highway bridge (2,000-2,500), less abundant below first lake (1,100-1,200), and scarce above second lake (65). Males outnumbered females in the spawning populations. Stream type fish were most abundant in the upstream spawning groups and upstream spawners were of smaller average size than downstream spawners. Some information on size of fry and smolts, and predators is also given.

Key words: Nanaimo River, salmon fry, smolts, chinook adults, abundance, size frequency.

RÉSUMÉ

Healey, M. C., and R. P. Jordan. 1982. Observations on juvenile chum and chinook and spawning chinook in the Nanaimo River, British Columbia, during 1975-1981. Can. MS Rep. Fish. Aquat. Sci. 1659: iv + 31 p.

En 1975, 1976, et de 1979 à 1981, nous avons surveillé la descente des alevins de saumon dans la rivière Nanaimo. En 1979 et 1980, nous avons recueilli des données sur la migration et la répartition des saumoneaux quinnats, et sur l'abondance et la répartition des sexes des reproducteurs de cette espèce. Le nombre des alevins quinnats, qui se rassemblaient près du rivage, s'élevait à 132 000 et 752 000, respectivement; celui des alevins kétas, répartis dans toute la rivière, s'élevait à 13 et 52 millions, respectivement. Les deux espèces étaient plus abondantes près de la surface qu'au fond. Les saumoneaux quinnats se tenaient au milieu de la rivière, lorsqu'ils migraient vers la mer, au début de juin pour la plupart. Les adultes quinnats étaient plus nombreux en aval du pont Island Highway (2 000 à 2 500), moins nombreux en aval du premier lac (1 100 à 1 200), et rares en amont du deuxième lac (65). Les populations de reproducteurs comptaient plus de mâles que de femelles. Les saumoneaux d'un an étaient plus nombreux dans les groupes se reproduisant en amont; ceux-ci étaient en moyenne de plus petite taille que les reproducteurs d'aval. Nous fournissons aussi quelques données sur la longueur des alevins et des saumoneaux, ainsi que sur les prédateurs.

Mots-clés: rivière Nanaimo, alevins, saumoneaux, adultes quinnats, abondance, fréquence des longueurs.

INTRODUCTION

During 1975 and 1976, in connection with an investigation of the early sea life of chum salmon (Oncorhynchus keta) (Healey 1979, 1980a; Healey et al. 1977, 1978), we monitored the downstream run of salmon fry in the Nanaimo River. In 1979, 1980, and 1981, in connection with an investigation of the productivity of chinook salmon (Oncorhynchus tshawytscha), we again monitored fry runs in the river. In May and June of 1979 and 1980, we also sampled chinook smolts migrating seaward and we obtained some additional information on chinook smolts from the fry trapping in 1979-1981. During 1978-1980 we gathered information on the size composition and racial composition of spawning chinook in the river, and in 1979 and 1980 we estimated the size of the spawning chinook populations by mark and recapture. The purpose of this report is to summarize the data on juvenile and adult salmon collected during these investigations.

FRY TRAPPING

METHODS

During 1975 and 1976 we fished five incline plane fry traps with mouth opening 75 × 90 cm in two side channels of the west branch of the Nanaimo River near the end of Makie Road at the upper margin of the estuary (Fig. 1). The trapping periods were March 9 to May 26, 1975 and April 2 to May 26, 1976. We fished the traps 24 h each day and removed the catch at 8:00 a.m., 8:00 p.m., and 12 midnight. These traps were downstream from all salmon spawning but were in a zone of tidal influence and their catch may have been affected by tides.

During 1979 and 1980, we fished two incline plane fry traps at a riffle about 200 m upstream from Cedar bridge (Fig. 1). The trap site was downstream from all chinook spawning, but was upstream from about 15% of the chum spawning. The traps were suspended from a cable stretched across the river, and on consecutive days we fished at five locations spaced equidistant across the river. During low flow periods site 1 on the east bank of the river was too shallow for the trap, and we dropped this fishing site from the usual rotation during low water. The trapping periods were March 21 to May 21, 1979 and March 12 to May 14, 1980. We fished the traps only at night.

A small side channel passing around an island on the west bank of the river at this site was not fished, although we did sample this channel by fyke net to confirm that fry moved down it. This channel carried, on average, about 15% of the surface river flow.

During 1981 we fished a single incline plane fry trap intermittently at the riffle above Cedar bridge from April 3 to May 12. The trap was fixed in position in the main flow and was fished only during the night.

During 1975 we estimated trapping efficiency by releasing marked fry upstream from the traps and recording the numbers captured by the traps (Healey et al. 1978). Efficiency was not measured in 1976, but, as the traps were fished in exactly the same way as in 1975 we have assumed that they fished with the same average efficiency. In these 2 yr we estimated total run from the trap catch and the estimate of trapping efficiency.

During 1979 and 1980 we recorded water level at the trapping site, and measured the depth profile of the river at the trapping site during several discharge levels. We then estimated the total run from the ratio of the area sampled by the trap to the total cross section of the river at the trapping site.

In 1981 the fry run appeared to be at its peak in the first week of April, so that we missed about half of the run. For the days when the trap was fished, we estimated fry run, as in 1979 and 1980, from the proportion of the cross section of the river sampled. We estimated fry run for the days not fished by interpolating between fishing days. Interpolation was also used to estimate fry run for the few days when the traps were not fished in 1979 and 1980.

We took daily measurements of water temperature at the trapping site in 1975, 1976, 1979 and 1980. We obtained discharge data from the Water Survey of Canada gauging station upstream from the Island Highway bridge.

Sampling in 1975 and 1976 provided information on the daytime movement of fry, and the proportion of the daily run occurring before and after midnight. Sampling at five sites across the channel in 1979 and 1980 provided information on the horizontal distribution of fry in the river. To obtain information on vertical distribution of fry we sampled at the trapping site above Cedar Bridge with two small (30 cm deep by 60 cm wide) fyke nets set in a frame so that one net fished the top 30 cm of water and the second the bottom 30 cm. This sampling was conducted during May 1-3, 1980.

RESULTS

Tables 1 to 5 show daily catch of chinook and chum fry in the incline plane traps, and estimates of daily run and total fry run for 1975 to 1981. Since the trapping technique varied between years, trap catch may only be compared between 1975 and 1976 and between 1979 and 1980. Chinook catch varied more than 2-fold for both these comparisons, and chum catch by less than 2-fold (Table 6).

The estimated total run of chinook fry ranged 307-752 thousand between 1975 and 1980, but was only 132 thousand in 1981. The estimate for 1981 is highly uncertain because of the limited trapping in that year. However, we also failed to find the usual numbers of chinook fry rearing in

the estuary in 1981, further suggesting that the run was low that year. Since escapement for the brood year was about average (see later), the poor chinook fry run in 1981 suggests poor egg to fry survival, probably owing to the midwinter floods that year.

The estimated total run of chum fry ranged 13-52 million from 1975-1981. Runs for 1979-1981 were low compared with 1975 and 1976. There was no indication that chum survival suffered to the extent that chinook survival did during the winter of 1981.

The timing of the chinook fry run was similar in 1975-1979, but was considerably earlier in 1980 and 1981. The chum run lagged behind the chinook run in all years except 1976, and was considerably later in 1980 (Table 6).

Temperature during the fry runs ranged about 4-14°C (Table 7). Although there were some differences between years (eg. 1979 and 1980 were warmer than 1975 and 1976) there was no apparent relationship between daily variation in temperature and variation in fry run.

River discharge during the fry run ranged about 400-6000 cfs, but exceeded 3000 cfs on only six occasions. Variations in discharge between years were comparativley small, and only in 1980 did high water ever effect trapping. There was no obvious relationship between fry catch and discharge for either chinook or chum. More subtle relationships may exist, however.

Catches of other salmonids in the fry traps were comparatively small. They consisted of a few hundred coho fry and smolts and a few chinook and steelhead smolts (Table 9). The trapping location in 1975 and 1976 was not suitable for capturing smolts, but should have been appropriate for coho fry. Over 400 coho fry were captured in 1975 but only 10 in 1976. The trapping location was better in 1979-1981, and more coho fry were captured in these years, particularly 1980 when 1,508 were captured. The catch of 115 in 1981, considering the few days of trapping, represents a large downstream migration of coho, perhaps comparable to 1980. The timing of the coho fry run was later than the chum and chinook fry runs, however, and moderate numbers of coho were still being caught at the termination of trapping each year (Table 9).

Fewer than 100 coho smolts were caught in every year except 1981. The catch of chinook and steelhead smolts was also high in 1981 (Table 9). Considering the small number of trapping days in 1981, these high catches indicate very good production of smolts in the spring of 1981. High discharge in the winter of 1981 apparently was not detrimental to overwinter survival, and may even have improved survival.

Only total fry counts were made for each daily time period in 1975 and 1976, not counts by species. Since chum fry predominated in the catch, the timing of the catch may indicate only the daily pattern of chum migration. In both years most of the catch was made after midnight (59 and 67% for 1975 and 1976 respectively), and relatively few were caught during the day (8 and 10% for 1975 and 1976, respectively).

In both 1979 and 1980 chum catches were greatest in high velocity water near the centre of the river, and catches were lowest near the east bank

where velocity was low. Chinook catches were similar at all trapping sites (Table 10). Catches were weighted according to velocity at the trap site to give an estimate of the relative density of fry per unit volume of water (Table 10). Relative density of chum was highest where velocity was high in 1979, but in 1980 chum density was highest on the west side of the river where velocity was low. Chinook density was greatest where velocity was lowest in both years. Chinook seem to be concentrated in low velocity water and near shore, while chum were generally distributed at random with respect to shore and velocity. Further evidence of the tendency of chinook to concentrate in low velocity water near shore comes from fyke net catches in the side channel on the west side of the river at the trapping site above Cedar Bridge. The ratio of chum to chinook fry in the fyke net catch ranged 0.6-14.2 to 1.0 while in the main river channel the ratio ranged 25.7-77.1 to 1.0 (Table 11).

Fyke nets set to fish the surface and bottom 30 cm of the river at the trap site above Cedar Bridge revealed that chum, coho and chinook fry were all more abundant at the surface than at the bottom, about twice as abundant in the case of chum and coho, and four times in the case of chinook (Table 12).

Non-random horizontal and vertical distributions of salmon fry can affect estimates of total run based on trapping data. Horizontal variation in fry abundance probably had little effect on total run estimates for the Nanaimo in 1979 and 1980 since all parts of the river were sampled about equally. Individual daily estimates are, however, likely to be biased high or low depending on the trapping site for that day. The effect of non-random vertical distribution is potentially more serious since we assumed that fry were equally abundant at all depths when we estimated total run size. For more than 30% of the time in both 1979 and 1980, however, the trap fished the whole water column, and, on average the trap fished more than 75% of the water depth. The potential overestimate of run size because of non-random vertical distribution, therefore, is on the order of 10%.

SMOLT TRAPPING

METHODS AND RESULTS

The first fishing for chinook smolts was carried out in June 1979. Our main objective in that year was to provide evidence that juvenile chinook rear in the Nanaimo River and are an additional run of fish to the juveniles which left the river as fry and reared in the estuary. We caught smolts with a fyke net at a downriver location below all spawning activity (Cedar Firehall) and at a mid-river location above the main fall chinook spawning areas (just below the highway bridge) (Fig. 1). We also obtained a sample of smolts from Whitewater Rapids in the upper Nanaimo River. This sampling confirmed the downstream movement of chinook smolts in June and that at least some smolts came from the upper reaches of the river (Table 11).

In 1980 we netted more extensively to determine better the timing, abundance, and vertical/horizontal distribution of smolts in the river.

We fished fyke nets 75 cm in diameter at a new mid-river location by Hub City gravel pit (Fig. 1) between 1900 and 0800 h the following morning on 16 nights between 7 May and 19 June. Peak catches at this sampling location were during the first 2 wk of June (Table 13). Some sampling was done at the downriver location, but catches there were generally equal to or smaller than catches in the upper river suggesting that most smolts came from the upper river (Table 13).

On two occasions we fished the fyke net during the day between 0900-1900 h. No fish were caught, suggesting that migration is limited to evening and night.

On June 10/11, we fished two identical fyke nets in water velocity of 1 m/sec at different distances from shore. Net 1 was positioned 15 m from shore, Net 2, 9 m from shore. The catches were 37 chinook and six trout in Net 1, and 12 chinook and one trout in Net 2. On June 12/13 and June 13/14, we fished three identical nets, again in water velocity of 1 m/sec but different distances from shore. Net 1 was 15 m from shore; Net 2 was 14 m from shore; Net 3 was 6 m from shore. The catches were as follows:

	Net 1	Net 2	Net 3
June 12/13	6 chinook	16 chinook	0 chinook
June 13/14	3 chinook	13 chinook	0 chinook

Nets further from shore consistently caught more fish, suggesting that, unlike chinook fry, chinook smolts avoid the edge of the river. The difference in catches between Nets 1 and 2 on June 12-14 is not a result of distance from shore as these nets were side by side. Net 1 was fully submerged, however, and Net 2 only 2/3 submerged, so that it sampled a greater width of river at the surface. On one occasion nets were set specifically to sample the surface and bottom for smolts. Only six smolts were captured but these were all at the surface. If the smolts always move at the surface it would account for the different catches in Nets 1 and 2.

Chinook smolts apparently have non-random horizontal and vertical distributions during downstream migration. Consequently it would be difficult to estimate the runs of chinook smolts by trap netting or fyke netting without conducting extensive sampling to determine the distribution of the smolts in the river.

SIZE OF FRY AND SMOLTS

The length and weight of chum fry captured during the downstream run was recorded in 1975. These data are presented in detail elsewhere (Healey et al. 1978). The chum fry averaged 36 mm fork length and 0.41 g wet weight.

Fry captured during the first few days of the run were larger than those captured during the main part of the run. Chinook fry captured during 1975 averaged 38.3 mm fork length and 0.57 g wet weight.

We collected further information on the size of chinook fry and smolts in 1979 and 1980. In both years fry averaged 38-39 mm long and 0.5-0.6 g. Smolts migrating in June were almost twice as long, averaging 60-70 mm, and usually over 3 g in weight (Table 14).

PREDATORS OF MIGRANT FRY

During the last week of April, 1980, we captured juvenile rainbow trout (Salmo gairdneri), coast range and prickly sculpins (Cottus aleuticus, C. asper), and starry flounders (Platichthys stellatus) by beach seine after dark in the Nanaimo River at the trap site above Cedar Bridge. We examined the stomach contents of these fish to determine whether they were feeding on migrating chum and chinook fry. Fifteen rainbow juveniles ranging 75-249 mm fork length had fed mainly on insect adults and larvae. Five had fish or fish remains in their guts of which two could be definitely identified as salmon fry, although the species was uncertain. None of the trout had fed on fry immediately prior to capture. Eight starry flounder, 63-77 mm long were mainly empty, and none had fish remains in its stomach. Thirty-nine prickly sculpin, 62-124 mm long, had fed mainly on larval insects although one had an unidentified salmon fry in its stomach. Twenty-eight coast range sculpin 36-84 mm long had also fed mainly on insect larvae, but three had fish remains in their stomach of which one was positively identified as a salmon fry. The incidence of predation, therefore, appears low. Without knowing the population size of predators in the river, however, it is impossible to say what impact fish predators might have on migrating fry.

ADULT CHINOOK SALMON RUNS TO THE NANAIMO RIVER IN 1979 AND 1980

METHODS AND RESULTS

Chinook spawning occurs in three separate areas of the Nanaimo River: 1) In the lower Nanaimo River, between Cedar bridge and the Island Highway; 2) In the upper Nanaimo River, 1 mile downstream from first lake; 3) In the upper Nanaimo River, downstream from fourth lake and possibly other locations in the headwaters.

Traditionally the lower Nanaimo River has had the greatest number of spawners, followed by the upper Nanaimo below first lake and lastly the upper Nanaimo River below fourth lake where less than 100 chinooks spawn. To obtain

a more precise estimate of spawners, we conducted a mark and recovery program in both the lower and upper Nanaimo River below first lake in 1979 and 1980. We captured unspawned fish in holding pools prior to peak of spawning and marked them by clipping the dorsal fin. After spawning we inspected dead fish for marks and recorded their orbit hypural length and sex. The results are given in Table 15. In both years between 1100 and 1200 chinook spawned below first lake and 2000-2500 spawned in the lower river.

Skin divers floated the Nanaimo River between third and fourth lake and counted 65 fish in 1980. No estimate for 1979 is available.

The sex composition of chinook salmon sampled during mark recovery was as follows:

	1979		1980	
	No. ♀	No. ♂	No. ♀	No. ♂
Lower Nanaimo River	331	528	161	180
Upper Nanaimo River	23	113	136	91

Males thus outnumbered females in the spawning populations by about 1.4 to 1. The true ratio may be somewhat more biased in favour of males, as many small males were seined during marking but comparatively few were present in the mark recovery sampling of spawned out fish.

The orbit-hypural length of males sampled during mark recovery ranged 27-94 cm (Table 16). Three distinct size groups of males were present in the lower river in 1979, a group of small fish averaging about 38 cm, a group of intermediate size fish averaging about 65 cm and a group of large fish averaging about 80 cm (Table 16). Three groups could also be distinguished in the males sampled in 1980. The separation was less obvious, however, and the fish were smaller, the small fish averaging about 34 cm, the intermediate fish about 60 cm and the large fish about 75 cm (Table 16). Males sampled from the upper river represented a smaller range of sizes and there were no obvious size groups (Table 16).

Females ranged 44-94 cm in length, although only one female was less than 54 cm (Table 16). Only one size group of females was present in the lower river and these averaged about 76 cm in both 1979 and 1980. Only one size group of females was present in the upper river as well and they were smaller, averaging about 69 cm (Table 16).

We investigated the proportion of stream and ocean type chinook in samples from the spawning grounds during 1977-1980. The Nanaimo River system produces mainly 0+ fish but also some 1+ chinook smolts. Table 17 gives a breakdown of stream and ocean type fish sampled in different parts of the river each year. Virtually all spawners in the lower river were ocean type (296/298), some spawners in the upper river below first lake were stream type (32/420) and a high proportion of headwater spawners were stream type (18/39). The proportion of stream type fish among upriver spawning populations declined from 1977-1980.

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Table 1. Catch of chum and chinook by inclined plane fry trap in the west channel of the Nanaimo River in 1975 and estimated daily run. Trap efficiency for chum (chinook) determined by mark-recapture.

Date	Trap % efficiency	Chinook catch	Chinook run	Chum catch	Chum run
Mar 9	-	0		444	(29,600)
10	-	0		240	(16,000)
11	2.42	0		119	4,919
12	3.35	1	57	220	6,569
13	3.85	2	114	376	9,776
14	1.05	6	258	335	31,993
15	0.90	2	171	373	41,527
16	0.65	3	171	246	37,884
17	0.58	2	124	255	43,860
18	0.86	4	228	257	29,940
19	0.43	7	54	216	50,760
20	0.83	11	570	186	22,320
21	1.99(16.6)	9	457	273	13,718
22	4.09	6	342	572	13,973
23	2.98	8	37	948	31,826
24	8.41	15	628	1,370	16,296
25	10.3 (13.3)	5	324	1,190	11,558
26	8.36	6	342	867	10,367
27	4.78	2	171	497	10,406
28	2.67	2	171	418	15,675
29	7.32	9	58	1,270	17,343
30	1.34	11	855	2,554	190,528
31	6.06	61	2,795	1,979	368,353
Apr 1	0.24	14	1,255	456	192,823
2	0.55	49	2,224	894	161,546
3	1.13	27	1,050	599	53,211
4	1.31	54	927	1,194	90,863
5	3.40 (3.43)	36	2,111	1,617	47,574
6	5.18 (6.14)	57	1,996	1,412	27,239
7	6.35	75	2,933	2,770	43,620
8	6.24	67	5,696	3,404	54,511
9	7.21 (3.14)	92	4,620	4,586	63,571
10	7.01 (3.04)	173	79,631	7,137	101,826
11	5.66	194	25,888	8,705	153,801
12	2.65 (0.72)	381	22,256	10,043	379,330
13	0.70 (1.13)	293	26,487	6,581	937,619
14	1.21 (0.97)	215	17,882	3,466	286,491
15	0.56 (1.04)	276	16,741	6,657	1,190,523
16	0.58 (1.43)	256	15,252	4,407	756,115
17	0.91 (1.19)	200	16,021	4,141	454,011
18	0.80 (3.15)	481	3,289	6,086	764,575
19	1.81 (4.84)	776	9,605	5,161	284,930
20	4.02 (7.94)	261	7,729	4,631	115,145
21	0.86 (1.58)	152	10,209	3,050	355,990
22	3.81 (1.29)	100	13,158	7,286	191,003

Table 1 (cont'd)

Date	Trap % efficiency	Chinook catch	Chinook run	Chum catch	Chum run
Apr 23	4.80	166	7,511	8,094	168,511
24	3.47 (1.73)	227	6,844	21,373	615,897
25	6.56 (4.95)	372	6,103	21,265	324,348
26	1.49	56	3,764	9,304	623,808
27	2.34	425	41,481	24,299	1,040,486
28	0.40	190	41,644	9,011	2,255,665
29	0.27 (0.60)	249	12,564	9,720	3,575,526
30	0.38 (0.95)	396	34,338	3,821	2,348,654
May 1	0.32 (2.58)	324	133,843	13,297	4,132,793
2	0.40 (1.48)	509	10,667	11,826	2,992,674
3	0.55 (0.61)	822	7,274	12,174	2,196,016
4	3.30 (1.57)	167	9,446	14,160	429,548
5	2.18 (2.78)	202	11,001	13,838	636,215
6	1.77 (1.41)	133	8,424	10,247	578,521
7	2.83 (2.47)	272	10,733	16,418	579,335
8	1.98 (2.78)	234	16,023	14,171	715,928
9	2.33 (4.63)	497	63,749	21,846	939,315
10	1.57 (2.75)	440	20,650	24,647	1,566,288
11	0.58 (0.49)	312	7,869	13,651	2,341,378
12	0.42 (0.50)	104	9,727	9,665	2,289,323
13	0.14 (0.61)	48	4,449	3,055	2,121,545
14	0.20 (0.67)	65	2,807	7,669	3,746,508
15	0.43	51	3,365	6,568	1,544,794
16	0.73 (1.67)	47	2,702	5,376	738,093
17	0.45	48	2,567	3,614	803,379
18	1.05	66	3,365	5,599	533,735
19	0.28	20	144	5,028	1,802,259
20	0.32	14	1,026	2,051	637,998
21	0.22 (3.47)	5	343	1,981	907,100
22	0.30	4	342	3,030	996,365
23	1.67	3	114	4,110	246,086
24	1.73	1	57	3,006	174,198
25	2.47	0		556	22,518
26	3.33	0		547	16,410
Total	0.86 (1.44)	10,870	752,931	449,495	52,352,862

Table 2. Catch of chum and chinook by inclined plane fry trap in the west channel of the Nanaimo River in 1976. Run estimates based on overall 1975 trap efficiency.

Date	Chinook	Chum
Apr 2	1	1,441
3	0	1,411
4	0	1,324
5	0	1,338
6	0	2,230
7	0	1,836
8	27	3,965
9	30	3,185
10	37	3,064
11	251	11,297
12	161	10,423
13	53	5,591
14	63	9,692
15	153	18,967
16	19	2,456
17	58	5,432
18	67	4,002
19	56	3,473
20	64	3,989
21	47	3,347
22	66	4,523
23	86	5,376
24	172	9,832
25	357	11,814
26	259	10,592
27	269	11,874
28	306	14,264
29	311	8,785
30	210	6,156
May 1	212	5,715
2	190	6,683
3	95	5,182
May 4	29	3,032
5	67	4,630
6	59	3,064
7	66	2,774
8	181	5,238
9	31	3,837
10	243	7,168
11	12	1,527
12	4	1,566
13	36	4,306
14	40	438
15	0	739
16	3	815
17	10	581
18	3	202
19	8	123
20	5	203
21	2	114
22	0	176
23	0	26
24	0	326
25	0	56
26	0	0
Total catch	4,419	240,200
Estimated run	306,875	27,930,233

Table 3. Catch of chinook and chum fry by inclined plane fry trap in the Nanaimo River above Cedar bridge in 1979, area sampled by the trap, river profile area and estimated daily run of chinook and chum.

Date	A Trap opening (cm^2)	B River profile (cm^2)	C No. chinook caught	$\frac{B \times C}{A}$ Estimated total no. chinook	D No. chum caught	$\frac{B \times D}{A}$ Estimated total no. chum
Mar. 21	10,800	256,200	41	973	84	1,993
22	12,600	315,600	12	300	766	19,186
23	12,600	305,700	23	558	761	18,463
24	12,600	243,000	88	1,697	509	9,816
25	10,800	256,200	29	688	24	569
26	12,600	338,700	21	909	262	7,043
27	12,600	266,100	36	760	770	16,262
28	12,600	206,700	37	607	1,807	29,643
29	11,700	243,000	111	2,305	887	18,422
30	10,800	256,200	60	1,423	548	13,000
31	11,700	200,100	139	2,377	1,314	22,473
Apr. 1	12,600	173,700	101	1,392	3,504	48,305
2	10,800	210,000	118	2,294	1,190	23,139
3	10,800	223,200	95	1,963	1,089	22,506
4	10,800	177,000	184	3,016	2,791	45,741
5	12,600	206,700	393	6,447	6,215	101,956
6	10,800	177,000	532	8,719	1,309	21,453
7	9,000	239,700	306	8,150	836	22,265
8	11,700	289,200	408	10,085	1,452	35,890
9	12,600	282,600	424	9,510	2,662	59,705
10	13,500	256,200	557	10,571	2,222	42,169
11	11,700	193,500	184	3,043	1,265	20,921
12	12,600	257,850	466	9,536	1,331	27,238
13	12,600	368,400	475	13,888	700	20,467
14	12,600	378,300	513	15,402	2,825	84,817
15	10,800	389,200	550	19,769	4,950	177,925
16	12,600	276,000	301	6,593	3,795	83,128
17	12,600	307,350	451	11,001	1,625	39,638
18	12,600	284,250	553	12,475	4,151	93,645
19	12,600	252,900	740	14,853	6,561	131,699
20	12,600	223,200	1,011	17,909	12,579	222,769
21	12,600	223,200	656	11,620	11,439	202,634
22	13,700	223,200	765	14,594	7,226	137,858
23	12,600	219,900	1,250	21,815	17,835	311,126
24	12,600	224,850	538	9,600	24,600	438,992
25	12,600	246,300	808	13,794	21,115	412,748
26	12,600	269,400	1,002	21,423	5,638	120,549
27	12,600	325,500	783	20,228	9,328	240,961
28	12,600	355,200	984	27,779	29,166	823,382
29	12,600	361,800	512	14,702	32,493	933,013
30	12,600	361,800	412	11,830	26,343	756,420

Table 3 (cont'd)

Date		A Trap opening (cm2)	B River profile (cm2)	C No. chinook caught	BxC / A Estimated total no. chinook	D No. chum caught	BxD / A Estimated total no. chum
May	1	12,600	355,200	375	10,571	7,483	210,949
	2	12,600	346,950	284	7,820	24,088	663,280
	3	12,600	338,700	395	10,618	40,097	1,077,846
	4	12,600	358,500	405	11,523	38,640	1,099,400
	5	12,600	427,800	188	6,383	9,030	306,590
	6	12,600	411,300	125	4,080	8,085	263,917
	7	12,600	365,100	110	3,187	14,490	419,865
	8	12,600	335,400	80	2,130	26,722	711,314
	9	12,600	299,100	54	1,282	17,325	411,262
	10	12,600	276,000	40	876	6,720	147,200
	11	12,600	259,500	8	165	5,720	117,805
	12	12,600	247,950	16	315	15,698	308,914
	13	12,600	208,350	58	959	10,815	178,833
	14	12,600	233,100	28	518	9,870	182,595
	15	12,600	246,300	81	1,583	8,085	158,042
	16	11,700	246,300	102	2,147	7,560	159,148
	17	12,600	243,000	50	964	4,830	93,150
	18	Trap not fishing			817 Est.	4,266	81,977
	19	Trap not fishing			670 Est.	3,702	70,804
	20	Trap not fishing			523 Est.	3,138	59,631
	21	10,800	203,400	20	377	2,573	48,458
Total				19,078	436,066	530,140	12,745,979

Table 4. Catch of chinook and chum fry by inclined plane fry trap in the Nanaimo River above Cedar bridge in 1980, area sampled by the trap, river profile area and estimated daily run of chinook and chum.

Date	A Trap opening (cm^2)	B River profile (cm^2)	C No. chinook caught	$\frac{BxC}{A}$ Estimated total no. chinook	D No. chum caught	$\frac{BxD}{A}$ Estimated total no. chum
Mar. 12	9,000	392,625	16	698	3	131
13	9,000	396,750	12	529	158	6,961
14	9,000	387,000	2	86	260	11,235
15	9,000	36,250	4	161	451	18,155
16	9,000	358,615	13	518	580	23,103
17	9,000	438,188	16	779	75	3,653
18	9,000	434,368	19	917	439	21,194
19	9,000	426,789	19	901	548	25,993
20	9,000	415,800	15	693	660	30,470
21	9,000	415,385	39	1,800	550	25,392
22	9,000	407,842	38	1,722	42	1,904
23	9,000	404,280	25	1,123	436	19,576
24	9,000	381,375	24	1,017	923	39,104
25	9,000	362,250	36	1,449	1,235	49,716
26	9,000	331,924	92	3,393	1,375	50,707
27	9,000	320,595	37	1,318	374	13,319
28	9,000	328,103	68	2,479	1,125	41,013
29	9,000	335,700	180	6,714	2,063	76,950
30	9,000	324,360	50	1,802	1,125	40,538
31	9,000	312,904	146	5,076	2,125	73,879
Apr. 1	9,000	297,678	146	4,829	731	24,180
2	9,000	282,495	206	6,466	1,916	60,141
3	9,000	274,930	115	3,513	2,797	85,433
4	9,000	271,113	971	2,922	3,813	114,856
5	9,000	278,777	364	11,275	4,422	136,935
6	9,000	350,894	255	9,942	875	34,115
7	9,000	354,694	229	9,025	1,438	56,673
8	9,000	373,702	312	12,955	3,200	132,871
9	9,000	468,694	402	20,935	2,875	149,724
10	9,000	476,296	358	18,946	3,000	158,767
11	9,000	434,504	133	6,421	1,000	48,278
12	9,000	407,904	251	11,376	4,500	203,930
13	9,000	415,500	222	10,249	6,000	277,000
14	9,000	495,303	326	17,941	7,300	401,743
15	9,000	514,286	168	9,600	4,320	576,244
16	9,000	472,500	120	6,300	1,920	100,800
17	9,000	461,108	158	8,095	6,120	313,548
18	Trap not fishing			7,671 Est.	6,510	338,393
19	Trap not fishing			7,247 Est.	6,900	363,238
20	Trap not fishing			6,823 Est.	7,290	388,083
21	9,000	483,882	119	6,398	7,680	412,928
22	9,000	419,318	154	7,175	11,880	553,522
23	9,000	381,273	88	3,728	8,400	355,880

Table 4 (cont'd)

Date	A Trap opening (cm2)	B River profile (cm2)	C No. chinook caught	BxC / A Estimated total no. chinook	D No. chum caught	BxD / A Estimated total no. chum
Apr. 24	9,000	358,473	112	4,461	4,440	176,860
25	9,000	335,667	108	4,028	11,520	429,696
26	10,800	324,290	298	8,948	18,300	549,508
27	10,800	320,494	154	4,570	21,720	644,561
28	10,800	331,920	75	2,305	19,920	612,171
29	8,100	316,671	84	3,284	4,080	159,523
30	10,800	301,493	131	3,657	16,560	462,300
May 1	8,100	301,472	64	2,382	16,120	600,022
2	10,800	309,140	133	3,807	15,860	453,919
3	10,800	282,555	80	2,093	8,160	213,444
4	10,800	267,355	98	2,426	7,320	181,170
5	10,800	290,079	213	5,721	12,480	335,227
6	10,800	286,315	94	2,492	9,480	251,308
7	10,800	267,408	25	619	2,921	72,295
8	10,800	252,124	29	677	2,760	64,426
9	10,800	233,100	48	1,036	4,920	106,190
10	Trap not fishing			975 Est.	3,720	79,847
11	10,800	229,312	43	913	2,520	53,503
12	10,800	244,543	28	634	960	21,733
13	9,900	236,893	14	335	720	17,229
14	10,800	236,800	27	592	960	21,058
Total			7,707	298,962	304,875	11,366,285

Table 5. Inclined plane trap catch of chinook and chum salmon fry in 1981 and estimated run. Run for days traps was not fished is from linear interpolation between catches.

Date	A Trap opening (cm2)	B River profile (cm2)	C No. chinook caught	BxC/A Estimated chinook run	D No. chum caught	BxD/A Estimated chum run
Apr. 3	6,300	385,000	31	1,894	7,700	470,555
4				3,059		388,128
5				4,222		305,701
6	6,300	465,000	73	5,388	3,025	223,274
7				3,406		322,856
8	6,300	390,000	23	1,424	6,824	422,438
9				1,334		374,313
10				1,244		326,188
11				1,154		278,063
12	6,300	335,000	20	1,064	4,249	229,939
13				1,220		237,783
14				1,376		245,627
15				1,532		253,471
16				1,688		261,315
17				1,844		269,159
18	6,300	450,000	28	2,000	3,878	277,000
19	6,300	410,000		2,026	3,700	240,794
20				2,051		213,996
21				2,077		187,198
22				2,103		160,400
23				2,128		133,798
24	6,300	522,000	26	2,154	1,289	106,803
25				1,899		102,503
26				1,644		98,203
27				1,389		93,903
28	6,300	420,000	17	1,133	1,344	89,600
29	6,300	445,000		975	647	45,700
30				816		47,013
May 1				658		48,326
2				500		49,952
3	6,300	428,000	5	340	750	50,952
4				227		42,577
5				114		34,202
6	6,300	360,000	0	0	452	25,828
7						17,556
8	6,300	340,000	0		172	9,283
9						5,808
10	6,300	300,000	0		49	2,333
11						1,530
12	6,300	270,000	0		17	728
Total			223	56,085	34,096	6,694,483

Table 6. Summary of total catch, median catch date, and total run estimate for chinook and chum fry, 1975-1981.

Statistic	1975	1976	1979	1980	1981[3]
Chinook					
Catch	10,870	4,419	19,078	7,707	223
Median date	Apr. 27	Apr. 27	Apr. 21	Apr. 10	~Apr. 5
Run	752,931	306,875	513,019[1]	351,678[1]	~132,000
Chum					
Catch	449,495	240,200	530,140	304,875	34,096
Median rate	Apr. 30	Apr. 24	May 1	Apr. 26	~Apr. 5
Run	52,352,862	27,930,233	14,995,269[2]	13,372,100[2]	~15,800,000

[1]Assumes 15% of chinook use side channel at trap site.
[2]Assumes 15% of chum spawn below trap site.
[3]Assumes run was half over when trapping began; that 15% of chinooks used side channel at trap site and that 15% of chum spawn below trap site.

Table 7. Temperature (°C) of the Nanaimo River taken in the morning at the trapping site during 1975-80.

Date	1975	1976	1979	1980
Mar. 9	3.1			
10	3.4			
11	4.1			
12	4.0			
13	4.3			
14	4.8			
Mar. 15	4.1			5.0
16	4.4			4.0
17	4.3			4.0
18	3.9			5.0
19	3.8			5.0
20	4.2		5.5	5.0
21	4.0		6.5	6.0
22	4.2		7.0	5.0
23	3.8		7.0	5.0
24	3.5		7.0	5.0
25	3.8		7.0	5.0
26	3.3		6.5	5.0
27	3.9		6.5	6.0
28	5.6		6.5	6.0
29	5.9		6.5	6.0
30	4.6		6.0	6.0
31	4.5		6.0	7.0
Apr. 1	6.3		6.0	7.0
2	4.9		6.0	7.0
3	6.1		7.0	6.0
4	6.8	6.0	8.5	8.0
5	6.8	6.0	8.0	7.0
6	7.4	5.4		7.0
7	7.7	7.0	7.5	7.0
8	8.0	5.5	8.0	7.0
9	8.5	6.5	8.0	7.0
10	8.5	6.0	7.5	8.0
11	8.6	6.5	8.0	8.0
12	7.3	7.5	7.0	9.0
13	7.7	5.5	6.5	9.0
14	8.1	5.5	6.5	9.0
15	7.5	6.0	7.5	9.0
16	7.3	5.5	7.5	8.0
17	7.5	6.0	7.0	9.0
18	6.5	7.0	7.0	9.0
19	6.5	7.0	8.0	
20	6.0	6.7	8.5	
21	6.8	6.7	8.0	9.0
22	6.4	6.7	8.5	9.0
23	6.8	6.7	10.5	9.0
24	6.8	7.0	10.5	9.0

Table 7 (cont'd)

Date		1975	1976	1979	1980
	25	7.0	6.5	11.0	9.0
	26	7.5	7.0	11.5	9.0
	27	7.3	7.3	12.0	10.0
	28	6.5	8.2	12.5	11.0
	29	7.3	8.7	12.5	11.0
	30	7.7	8.8	12.0	12.0
May	1	7.5	9.3	11.5	11.0
	2	7.5	9.1	11.0	12.0
	3	6.8	8.5	10.5	12.0
	4	7.6	9.0	10.5	12.0
	5	7.3	8.5	11.0	12.0
	6	7.7	8.5	11.0	11.0
	7	7.9	9.4	10.5	12.0
	8	8.7	10.8	11.0	11.0
	9	9.2	10.6	12.0	10.0
	10	8.3	10.5	11.0	12.0
	11	8.3	9.7	11.0	15.0
	12	8.3	9.5	11.5	14.0
	13	9.5	9.7	11.5	14.0
	14	9.6	9.2	13.0	13.0
	15	9.7	10.6	13.0	
	16	9.4	11.2		
	17	8.9	10.3		
	18	9.0	10.0		
	19	9.3	9.7		
	20	10.2	10.7		
	21	10.3	10.3		
	22	9.4	10.7		
	23	9.2	11.0		
	24	10.1	11.2		
	25	11.3	10.3		
	26	10.3	10.3		

Table 8. Nanaimo River flow in cfs at Granby Gauge above the Island Highway bridge in 1975-1981.

Date	1975	1976	1979	1980	1981
Mar. 9	961				
10	898				
11	869		1,686	1,091	588
12	883		1,694	1,210	560
13	876		1,614	1,315	540
14	969		1,455	1,259	520
15	1140		1,590	1,157	498
16	1240		1,855	1,027	520
17	1550		1,670	1,011	524
18	1680		1,399	912	513
19	1460		1,151	1,511	483
20	1300		1,038	1,455	458
21	1280		1,000	1,476	430
22	1200		978	1,455	412
23	1070		1,000	1,455	440
24	957		1,073	1,350	494
25	847		1,151	1,189	628
26	756		1,097	1,055	874
27	696		961	956	846
28	669		824	873	771
29	796		730	961	890
30	848		630	956	1,099
31	850		567	895	1,620
Apr. 1	862		515	830	2,028
2	865	1380	480	750	1,772
3	851	1170	448	695	1,458
4	814	1090	439	680	1,200
5	774	1100	504	680	1,996
6	769	1490	607	956	2,310
7	772	1770	705	1,022	1,900
8	824	1960	730	1,000	1,500
9	940	2140	775	1,385	1,304
10	1,140	2060	770	2,170	1,140
11	1,480	2370	710	1,966	1,170
12	1,770	2560	645	1,567	1,146
13	1,680	2170	1,455	1,455	1,055
14	1,610	1800	1,872	1,590	1,000
15	1,720	1540	1,614	2,554	1,022
16	1,750	1280	1,266	2,320	1,860
17	1,710	1160	1,016	1,766	2,220
18	1,760	1080	862	2,000	2,060
19	1,620	1010	780	6,070	1,660
20	1,410	913	680	5,400	1,500
21	1,270	833	630	2,975	1,360
22	1,250	741	585	1,872	1,395
23	1,250	755	594	1,434	2,500
24	1,270	916	612	1,189	3,000

Table 8 (cont'd)

Date		1975	1976	1979	1980	1981
	25	1,220	966	680	1,067	2,742
	26	1,330	940	813	961	1,916
	27	1,360	965	1,000	895	1,374
	28	1,280	1,080	1,315	950	1,740
	29	1,220	1,360	1,515	967	2,004
	30	1,280	1,980	1,552	890	1,900
May	1	1,570	2,620	1,530	807	1,716
	2	3,050	3,230	1,441	890	1,740
	3	3,130	2,790	1,315	846	1,820
	4	2,470	2,310	1,385	755	1,740
	5	2,060	2,020	1,670	745	1,500
	6	1,820	1,760	2,190	857	1,278
	7	1,720	1,690	1,750	813	1,182
	8	2,030	2,080	1,385	730	1,134
	9	3,000	2,490	1,145	645	1,055
	10	3,530	2,780	972	594	961
	11	2,950	2,630	835	585	890
	12	2,290	2,070	730	670	796
	13	2,230	1,680	680	665	735
	14	2,500	1,500	680	598	712
	15	2,260	1,330	690	550	676
	16	2,010	1,320			
	17	2,030	1,400			
	18	1,920	1,310			
	19	1,560	1,160			
	20	1,370	1,010			
	21	1,320	934			
	22	1,300	898			
	23	1,140	855			
	24	1,000	894			
	25	954	1,050			
	26	954	1,620			

Table 9. Catch of coho fry and smolts, 90-day and yearling chinook smolts and steelhead smolts by inclined plane fry traps in the Nanaimo River 1975-1981. Coho fry and smolt catches are shown by 5-day period, chinook and steelhead only by year.

Species and date	1975		1976		1979		1980		1981	
	Fry	Smolt	Fry	Smolt	Fry	Smolt	Fry	Smolt	Fry	Smolt
Coho										
March	0	0	-	-	2	1	4	1	-	-
Apr. 1-5	0	0	1	0	1	3	5	0	10	2
6-10	0	0	0	0	1	3	1	1	30	13
11-15	0	0	0	1	1	7	11	1	20	20
16-20	0	0	0	1	0	1	10	2	13	23
21-25	0	0	0	0	0	2	55	13	10	14
26-30	0	0	0	1	2	17	248	6	25	41
May 1-5	2	1	1	0	31	6	573	1	4	2
6-10	201	3	5	1	53	5	429	0	3	13
11-15	176	0	3	0	138	0	172	0	0	55
16-20	30	1	1	0	222	0	-	-	-	-
21-25	22	0	0	1	142	1	-	-	0	72
26-30	0	0	0	0	-	-	-	-	0	12
Total	431	5	10	5	593	46	1,508	25	115	267
Chinook										
90-day		-		-		-		-		63
Yearling		-		-		2		6		10
Steelhead		-		-		24		47		67

Table 10. Percent of chinook and chum fry captured at trap positions 1-5 during 1979 and 1980, relative water velocity at each position, and relative density of chum and chinook at each position. Velocity and density shown relative to position with greatest velocity or density.

Feature	Year	Trap position				
		1	2	3	4	5
Chum catch	1979	5.8	13.2	28.5	33.9	18.6
	1980	4.9	16.9	25.3	27.0	25.8
Chinook catch	1979	21.0	16.0	19.6	20.1	23.2
	1980	15.8	17.7	21.2	19.1	26.4
Relative velocity	1979	0.46	0.67	0.98	1.0	0.69
	1980	0.66	1.0	0.80	0.80	0.48
Relative chum density	1979	0.37	0.58	0.86	1.0	0.79
	1980	0.14	0.31	0.59	0.62	1.0
Relative chinook density	1979	1.0	0.52	0.44	0.44	0.74
	1980	0.44	0.33	0.49	0.44	1.0

Table 11. Catch of chum and chinook fry by fyke net in the side channel at the trap site above Cedar bridge compared with the catch by inclined plan trap in the main river channel, and the ratio of chum to chinook.

	Side-channel fyke net			Main channel trap			
Date	A Chum	B Chinook	A/B Ratio	Trap Position	A Chum	B Chinook	A/B Ratio
Apr. 15/16	123	191	0.6	1	4320	168	25.7
21/22	209	69	3.0	3	7680	119	64.5
22/23	327	23	14.2	4	11880	154	77.1

Table 12. Catch of chinook, coho and chum fry in fyke nets set to fish the top 30 cm and bottom 30 cm of the depth profile at the trapping site above Cedar bridge.

		Catches	
		Top	Bottom
May 2, 1980	Chinook fry	13	3
	Coho fry	7	2
	Chum fry	1842	597
May 3, 1980	Chinook fry	24	7
	Coho fry	28	13
	Chum fry	3023	1536

Table 13. Catch of chinook smolts by fyke net in the upper (above highway bridge) and lower (above Cedar bridge) Nanaimo River in 1979 and 1980.

Date	Upper river		Lower river	
	1979	1980	1979	1980
May 7/8	Not fished	0	Not fished	Not fished
22/23	" "	13	" "	" "
26/27	" "	4	" "	" "
28/29	" "	4	" "	" "
29/30	" "	7	" "	" "
June 2/3	Not fished	33	Not fished	Not fished
2/3	" "	Not fished	" "	51
4/5	" "	56	" "	31
6/7	" "	53	" "	24
8/9	" "	45	" "	20
11/12	" "	37	40	Not fished
12/13	2	16	Not fished	" "
13/14	Not fished	13	" "	" "
16/17	" "	0	" "	" "
17/18	12	1	" "	10
18/19	6	0	" "	3
19/20	Not fished	Not fished	18	
20/21	" "	" "	3	

Table 14. Fork length (mm) and preserved weight (g) of chinook fry and smolts captured in the Nanaimo River in 1979 and 1980. * represents the first catch of smolts. Catches prior to this date were all fry, catches after were all smolts.

Date	1979					1980				
	N	$\bar{L}$	Range	$\bar{W}$	Range	N	$\bar{L}$	Range	$\bar{W}$	Range
Apr. 9	30	38.8	35-41	0.53	0.36-0.65			-		-
17			-		-	20	39.3	36-41	0.54	0.41-0.64
May 1-10	60	38.2	35-40	0.56	0.41-0.69			-		-
11-20	30	38.6	37-44	0.57	0.42-1.00			-		-
21-31	30	39.4	36-48	0.58	0.42-1.24	25*	60.2	52-70	2.61	1.64-4.29
June 1-10			-		-	50	64.5	49-75	3.22	1.29-5.30
11-20	78*	67.6	52-84	3.76	1.65-6.57	20	65.9	55-76	3.52	1.98-5.40
21-30	3	70.0	65-76	4.14	3.30-5.22			-		-

Table 15. Population estimates of adult chinook spawners in the Nanaimo River from mark and recapture information collected in 1979 and 1980.

Location	Year	No. marked	No. recov.	No. inspected	Pop. estimate
Upper Nanaimo River	1979	136	18	149	1126
(1 mi below 1st Lake)	1980	112	22	234	1191
Lower Nanaimo River	1979	283	99	859	2456
(Cassidy to Cedar)	1980	228	54	506	2136

Table 16. Length frequencies (orbit-hypural length) of dead spawned chinook salmon sampled in 1979 and 1980.

Hyp.L. (cm)	1979				1980			
	Lower R.		Upper R.		Lower R.		Upper R.	
	♀	♂	♀	♂	♀	♂	♀	♂
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	1	-	-	-	-	-	-
28	-	1	-	-	-	-	-	-
29	-	1	-	-	-	1	-	-
30	-	5	-	1	-	-	-	-
31	-	3	-	-	-	3	-	-
32	-	5	-	1	-	8	-	-
33	-	7	-	1	-	6	-	1
34	-	16	-	1	-	13	-	-
35	-	13	-	-	-	7	-	-
36	-	22	-	-	-	11	-	1
37	-	30	-	-	-	8	-	1
38	-	17	-	1	-	9	-	2
39	-	15	-	-	-	6	-	1
40	-	19	-	-	-	2	-	1
41	-	16	-	1	-	5	-	-
42	-	12	-	-	-	2	-	1
43	-	14	-	3	-	2	-	-
44	1	16	-	1	-	4	-	2
45	-	8	-	3	-	2	-	1
46	-	7	-	1	-	2	-	1
47	-	6	-	1	-	4	-	1
48	-	3	-	1	-	4	-	2
49	-	2	-	1	-	2	-	2
50	-	1	-	3	-	2	-	2
51	-	3	-	5	-	4	-	1
52	-	1	-	1	-	6	-	1
53	-	5	-	3	-	8	-	3
54	-	5	-	2	-	10	-	5
55	-	3	2	1	-	9	1	4
56	1	9	-	2	1	8	1	2
57	3	8	-	2	-	10	-	2
58	1	6	2	4	-	16	2	2
59	2	4	-	3	1	21	2	3
60	2	10	2	8	1	16	3	3
61	2	9	3	1	2	9	1	4
62	4	12	6	2	4	19	6	3
63	4	15	2	5	4	7	7	1
64	4	14	4	1	2	13	8	1
65	8	10	6	1	1	12	10	3
66	3	9	4	2	8	4	13	3
67	12	10	6	4	2	3	7	3

Table 16 (cont'd)

HyP.L. (cm)	1979				1980			
	Lower R.		Upper R.		Lower R.		Upper R.	
	♀	♂	♀	♂	♀	♂	♀	♂
68	13	13	8	2	9	8	14	5
69	14	7	8	1	4	5	10	2
70	17	8	2	3	3	7	14	7
71	12	10	5	3	6	5	5	2
72	16	11	1	2	10	6	6	9
73	20	4	2	1	2	4	7	1
74	13	3	1	-	10	1	6	2
75	22	7	-	1	9	4	5	3
76	27	6	1	-	11	4	2	1
77	22	4	1	2	5	3	2	2
78	26	16	-	-	10	1	3	-
79	18	7	1	-	16	6	-	-
80	17	17	-	-	6	3	1	-
81	10	8	-	-	8	2	-	1
82	7	15	-	-	4	2	-	-
83	11	3	-	-	3	1	-	-
84	4	4	-	-	3	2	-	-
85	3	3	-	-	4	1	-	-
86	3	4	-	-	4	1	-	-
87	4	1	-	-	3	-	-	-
88	4	-	-	-	2	-	-	-
89	-	1	-	-	-	-	-	-
90	-	1	-	-	2	-	-	-
91	1	1	-	-	-	-	-	-
92	-	-	-	-	1	-	-	-
93	-	-	-	-	-	-	-	-
94	1	1	-	-	-	-	-	-

Table 17. Number of stream and ocean type spawning chinook in samples from the Nanaimo River (from scale readings).

Location	1977		1978		1979		1980	
	0+	1+	0+	1+	0+	1+	0+	1+
Cedar-Cassidy	21	1	91	1	74	0	110	0
1 mi below 1st Lake	12	6	34	11	131	10	211	5
Above 3rd Lake	Not sampled		Not sampled		1	5	20	13

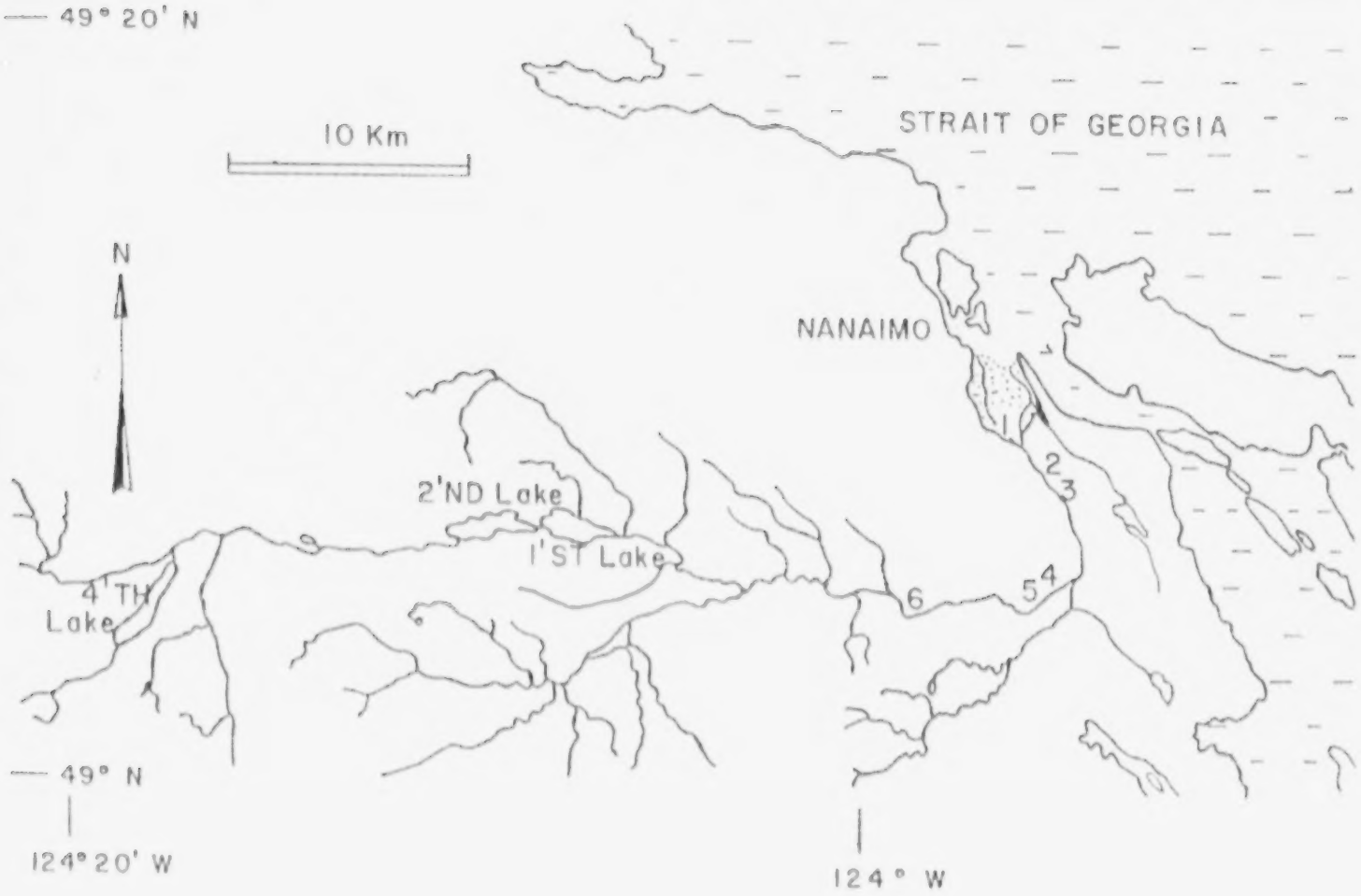

Fig 1. Map of the Nanaimo River showing major landmarks. 1: Incline plane trapping site in 1975 and 1976. 2: Incline plane trapping site in 1979-81. 3: Cedar Firehall fyke netting site. 4: Island highway fyke netting site. 5: Gravel pit fyke netting site. 6: White water rapids fyke netting site.